

The Golden Sun-moth *Synemon plana* (Castniidae) on Victoria's remnant southern native grasslands

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Abstract

The complex adult biology of the Golden Sun-moth *Synemon plana* Walker is outlined, and the difficulties of appraising its conservation status and needs in Victoria are discussed. (*The Victorian Naturalist* 124 (4), 2007, 254–257)

Introduction

The day-flying Golden Sun-moth *Synemon plana* Walker now occurs on a number of remnant patches of native grassland in south-eastern Australia, with a range encompassing parts of Victoria, New South Wales (NSW) and the Australian Capital Territory (ACT). It has become an important invertebrate flagship for this endangered ecosystem. *S. plana* is a member of a distinctive endemic genus of Castniidae, many species of which are scarce and highly localised (Douglas 1993). Several studies in Victoria have been important in elucidating its biology and conservation needs. Genetic studies (Clarke and O'Dwyer 2000; Clarke 2000) imply that Victorian populations may be rather distinct from the remainder of the species.

Biology and incidence

Synemon plana is associated with grassland sites with a high cover of *Austrodanthonia*, low growing wallaby grasses, several species of which have been inferred to be food plants for the subterranean caterpillars. The duration of the life cycle remains uncertain: although there are strong implications that it may be univoltine, developmental periods of two or three years have also been suggested. Eggs are laid at the base of grass tussocks, and the caterpillars feed on the grass roots. In southern Victoria, the adult flight season extends over about two months in late spring and early summer, with variations reflecting temperature and locality. Adult moths live for only a few days, and do not feed. Males patrol actively in search of mates, but

females are relatively inactive. They are regarded as 'semi-flightless' and tend to rest on the ground, exposing their brightly coloured hind wings in response to males flying overhead. Males then land, and mating occurs. However, most males are active only at temperatures above about 22° C, on calm days in bright sunlight, and for a few hours in the middle of the day. Under other conditions, and at other times, their numbers can not be assessed. At least part of the reason for the putative scarcity of the moth reflects this aspect of the moth's activity. Some past surveys may have been undertaken under conditions or at times at which the moth would be unlikely to have been detected. Likewise, comparisons of abundance across sites are difficult to validate, and no more than a very few sites may be assessable by a single observer on any day because of the short daily flight period. Under suitable conditions, counts of active moths can be based on either transect walks or point surveys (Gibson and New 2007).

The short adult life also renders it impossible to obtain sound population estimates on any single visit to a site. All adults present on that visit are likely to be replaced by others by the following week, and not to have been present in the previous week: any single count can represent only the restricted emergence cohort present at that time, and this can not be reflective of the entire resident population present. Likewise, distribution patterns are equally hard to determine. Braby and Dunford (2006) and others have shown, by repeated visits spanning the whole flight season to

sites near Canberra, that the distribution of the moth may change dramatically as the season progresses. Rather than movement, this pattern may reflect differences in aspect and insolation across a site, so that emergencies are earlier or later in different areas as a consequence of soil temperature. Local 'hotspots' of abundance may simply be 'hot spots'!

Recent surveys throughout the moth's range, and increasing biological understanding, particularly of its adult behaviour as above, are progressively leading to improved approaches to assessing its conservation needs, and dependence on particular habitat features and native grass food plants. Thus, following pioneering study of a population at Mount Piper, Broadford, O'Dwyer and Attiwill (1999, 2000) partially characterised favourable habitat for the moth and quantified some parameters of the needs for restoration of native grasses on degraded sites, as an initial model for wider appraisal.

In short, *S. plana* can be elusive in surveys, and its numbers difficult to quantify. This elusiveness, rather than genuine absence, has probably led to a misleading impression of its scarcity. It has often been declared absent (equated to population loss) on grassland patches, and to have disappeared from sites on which it has historically been reported. Some such losses are undoubtedly genuine, but others may not be, as improved searching capability continues to reveal additional populations throughout its range.

Conservation status

Synemon plana is listed federally as 'Critically Endangered', under the ACT and NSW acts as 'Endangered', and as a 'threatened species' in Victoria. These listings collectively cover the species' entire range.

At the time of Clarke's (2000) summary, *S. plana* was known to occur at few Victorian localities, with information suggesting that it had been lost from 48 of the 60 historically recorded localities in the state. Braby and Dunford (2006) noted its current presence on 31 sites in ACT and 42 in NSW. About 8 extant Victorian populations were known to Clarke (2000), but many more have since been reported (for

example by Van Praagh [2004] and Endersby and Koehler [2006]). Many of the occupied sites are very small, of a few hectares or less, and many are indeed isolated grassland remnants. Threats to the moth noted for New South Wales include loss and degradation of habitat from agricultural and urban development, pasture enrichment with replacement of native grasses by exotic species, overstocking and overgrazing by domestic stock, weed invasion, and general fragmentation and isolation of remaining patches from a variety of developments. Similar threats and losses have occurred in Victoria and the ACT. Conservation management throughout the moth's range emphasises protection of the sites on which it is known to occur, particularly those on which the moth is adjudged abundant, so that *S. plana* is an important umbrella for less heralded taxa of native grasslands, as one of the few notable invertebrates characteristic of these ecosystems.

Despite obligations to conserve populations of listed threatened species, recent cases near Melbourne have given the moth some notoriety because of its presence on sites scheduled for housing or industrial development, and the needs to seek adequate compromise between conservation and development. Decisions to sacrifice the habitat of some (or parts of some) colonies have been justified by the moth's presence on other sites, but the wider view that the remnant grasslands themselves are now sufficiently scarce and vulnerable to merit total conservation is difficult to assert in the face of strong economic opposition. Many such sites are very small. Nevertheless, one outcome of this pressure from developers has been to stimulate further and more comprehensive surveys for the moth around Melbourne. However, in common with other listed threatened species, there is currently no formal 'centralised' system in which records of incidence of *S. plana* are progressively deposited, and many such records remain informal or in reports of very limited availability or circulation. Recent conservation interest has also been fostered by the discovery of the moth on a much larger suite of grasslands, the Craigieburn Grasslands Reserve and nearby Cooper Street grasslands, in work stimulated by plans for a

nearby freeway/ bypass (see Van Praagh 2004), where the moth is distributed over several square kilometres. Craigieburn Grasslands is the largest known habitat patch for *S. plana* in Victoria, and study of the moth there has been organised through the Merri Creek Management Committee and Parks Victoria. The site has potential to be a major reserve for the moth, and is sufficiently large to facilitate study of its populations and to trial manipulative management on a scale impossible on the more numerous small sites. Much of the survey protocol noted earlier (Gibson and New 2007) was based on observations at Craigieburn, for example. Because of its proximity to numerous other (small) grassland remnants in the outer Melbourne region, monitoring the flight period of *S. plana* at Craigieburn may be a valuable indicator of when to search for it elsewhere, so increasing the efficiency of further exploration.

Two additional inferences from recent studies are important contributions to the debate over the conservation status and needs of *S. plana*.

(a). Improved search methods are yielding new populations every season, and there now appear to be many more populations than earlier supposed. Whilst many of these may be vulnerable, a number are also in reserves, and there is considerable potential for practical conservation management to be instituted. Most of the work leading to knowledge of the moth's distribution flowed directly from its formal election as an endangered species. The major grounds for listing involved the fragmentation of habitat, and the progressive isolation of populations, with attendant vulnerability from continuing changes and disturbance to grassland habitat extent and quality. The advice to the federal Minister for the Environment from his Threatened Species Scientific Committee (2005) supporting the nomination for listing *S. plana* under the *Environment Protection and Biodiversity Conservation Act* emphasised also the lack of information on population sizes and dynamics of the moth, and acknowledged its very high abundance in places – but that many of those places were indeed vulnerable to

fire and stochastic events, as well as to more predictable influences of weed invasion and other edge effects. This scenario remains valid, but the higher number of populations now known may lead to some downward revision of conservation status through affording greater collective security.

(b). The moth has been presumed to depend entirely and obligately on native grasses, predominantly *Austroanthonia* spp. for larval food, so that the presence of these grasses, and their maintenance at high levels (O'Dwyer and Attiwill [2000] implied need for at least 40% cover of *Austroanthonia* at Mount Piper) is a fundamental plank in the current conservation platform.

However, Braby and Dunford (2006) have raised the intriguing possibility that *S. plana* caterpillars might also feed on the roots of Chilean needle grass *Nassella neesiana*, an exotic weedy grass introduced from South America. The evidence is currently circumstantial, based on presence of pupal shells close to this plant in the ACT. This grass is present at Craigieburn and on some other Victorian sites. It is aggressive, and is a target for suppression to control its competition with native grasses. As Braby and Dunford (2006) have noted, further work is needed to clarify this possible association and the extent to which this weed is indeed used by *S. plana*. Some of the sites on which *S. plana* has been discovered recently near Melbourne appear to be substantially degraded, with relatively little *Austroanthonia* present. Should its association with *Nassella* (or other exotic species) be found to be significant, the novel prospect may exist of needing to conserve selected populations of *Nassella* on sites where *Austroanthonia* is sparse, at least as an interim measure to host the moth until more natural foods are plentiful.

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Museum specimen of a male Golden Sun-moth *Synemon plana*. Photograph supplied by Lucy Gibson.